

204-TYPE SELECTORS

REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 204-type selectors (minor switch).

1.02 This section is reissued to revise the List of Tools, Gauges, Materials, and Test Apparatus and to revise the procedures indicated by change arrows. This reissue does not affect the Equipment Test List.

1.03 Reference shall be made to Section 020-010-711 covering general requirements and definitions for additional information necessary for the proper application of the requirements listed herein.

1.04 *Asterisk (*)*: Requirements are marked with an asterisk when to check for them would necessitate dismantling or dismantling of apparatus or would affect the adjustment involved or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.

1.05 *Normal Position of Selector (Fig. 1)*

(a) *On 204A, B, C, and E selectors*, the normal position is that position in which the normal finger rests against the stop and the wiper springs clear the first bank contact.

(b) *On 204F selectors*, the normal position is that position in which the normal finger rests against the stop and the lower wiper springs clear the first bank contact on the multicontact side of the lower bank level.

1.06 *One dip of KS-16832 L2 lubricant* for the purpose of this section is the amount of lubricant retained on a KS-14208 brush after being dipped into the lubricant to a depth of 1/2 inch and the tip lightly touched against the edge of the container to remove any surplus.

1.07 *A selector is said to operate* when it completes a step to the next terminal from its preceding position.

1.08 *A selector is said to nonoperate* when the rotary magnet does not operate the off-normal springs and the selector does not advance one step.

1.09 *Preparation of KS-16832 L2 Lubricant:*

This lubricant is provided in 2-ounce and 1-pint containers. A small wide-mouth container, such as the 2-ounce jar in which the lubricant is available, should be used as a receptacle from which to dispense the lubricant. If allowed to stand more than 1 day without agitation, the lubricant ingredients tend to separate; therefore, before each day's use, shake the container of lubricant for approximately 30 seconds to insure mixing of the ingredients. The proper method of shaking the lubricant consists of repeated, rapid turning of the container to an upside down position and back to the upright position. If the lubricant from a 1-pint container is to be used, the lubricant must be mixed as just described before it is poured into the smaller container. Under storage conditions, the cover shall be tight on the container.

2. REQUIREMENTS

2.01 *Cleaning*

(a) Contacts shall be cleaned, when necessary, in accordance with approved procedures.

(b) Other parts shall be cleaned, when necessary, in accordance with approved procedures.

2.02 *Cleaning and Treating of Bank Contacts and Wipers*

(a) *Removal of Dust and Loose Particles:*
Dust and loose particles shall be removed from all bank contacts and wipers with an approved bristle brush or other approved means.

(b) *Cleaning and Treating of Bank Contacts*

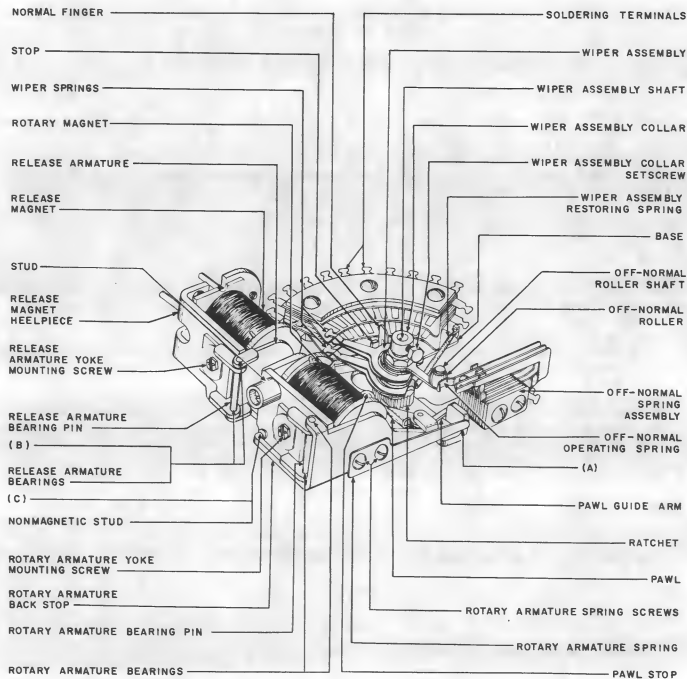


Fig. 1—204-Type Selector

(1) **Banks Equipped With Silver-Plated Contacts** (Applies After Turnover Only):

The contacts shall be treated with No. 30 oiled sleeving before extensive operation of the selectors. In no case shall No. 29 aloxite sleeving be used for cleaning these contacts.

Note: Silver-plated bank contacts are subject to tarnish. In order to protect the finish, no attempt should be made to remove this tarnish as it is not detrimental electrically in the normal operation of the apparatus.

(2) **Banks Equipped With Brass Contacts** (Applies After Turnover Only):

The contacts shall be cleaned with No. 29 aloxite sleeving followed by treating with No. 30 oiled sleeving.

(c) **Cleaning and Treating of Bank Wipers**

(Applies After Turnover Only): The wipers shall be treated with No. 30 oiled sleeving when the associated bank contacts are treated.

(c) **Interval for Cleaning and Treating of Bank Contacts and Wipers:** Ordinarily after turnover, bank contacts and wipers treated with No. 30 oiled sleeving should not require treating more frequently than at yearly intervals. This interval may be extended if experience indicates that local conditions are such as to insure that the contacts will be satisfactory during the extended interval.

2.03 Lubrication

(a) The following parts shall be adequately lubricated with KS-16832 L2 lubricant. When lubrication is necessary, the lubricant shall be applied as shown in Table A.

TABLE A - LUBRICATION

PART	AMOUNT	LUBRICATION POINT
Rotary Armature Spring		Fig. 1(A) (bearing surface on the frame)
Pawl Bearing	Distribute one dip between lubrication points [Fig. 1(A), 2(A), 2(B), 2(C), 3(A), and 3(C)]	Fig. 2(A) (both ends of bearing)
Pawl Stop		Fig. 2(B) (where pawl stop is engaged by pawl)
Pawl Guide Arm		Fig. 2(C) (bearing surface at frame)
Release Armature Spring		Fig. 3(A) (bearing surface on the normal stop)
Wiper Assembly Bearing		Fig. 3(C)
Release Armature Bearing Pin	Divide one dip between lubrication points	Fig. 1(B) (where pin touches bearing yoke)
Rotary Armature Bearing Pin	[Fig. 1(B) and 4(A)]	Fig. 4(A) (where pin touches bearing yoke)
Ratchet Teeth	Distribute one dip over ratchet teeth	Fig. 3(B) (where pawl and release ratchet dog engage ratchet teeth)

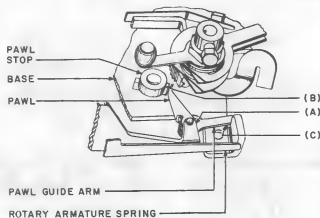


Fig. 2—Lubrication Points for Wiper Assembly Pawl Stop

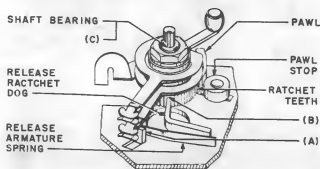


Fig. 3—Lubrication Points for Wiper Assembly Ratchet

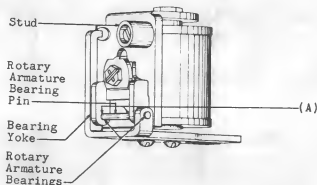


Fig. 4—Lubrication Points for Rotary Magnet

- (b) **Recommended Lubrication Intervals:** After turnover, it is recommended that the parts listed in requirement (a) be lubricated at intervals of 1 year. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure that requirement (a) will be met during the extended interval.

Note: Where the KS-16832 L2 lubricant is used, experience may indicate that after the first few applications some of the lubricated parts may require less frequent lubrication, and in such cases the lubrication interval may be extended for these parts.

- 2.04 Record of Lubrication:** During the period of installation, a record shall be kept, by date, of lubrication and this record shall be turned over to the telephone company with the equipment. If no lubrication has been done, it shall be so stated.

WIPER ASSEMBLY REQUIREMENTS

- 2.05 Wiper Assembly Play:** The wiper assembly shall not bind on the shaft and shall have perceptible endplay.

Gauge by eye and feel.

- 2.06 Wiper Spring Tip Separation:** Fig. 5(A)—There shall be a separation between the tips of each pair of wiper springs with the wiper springs off the bank of

0.015 inch

Gauge by eye using the P-220366 dental mirror. (The thickness of a bank contact spring is 0.016 inch.)

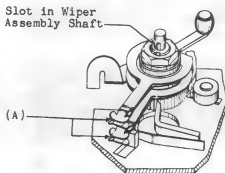


Fig. 5—Wiper Assembly

2.07 Wiper Spring Tension

- (a) The wiper spring shall have sufficient tension so that, when the wiper assembly is moved off the bank and the pressure of one spring in the pair is removed, the follow of its mate measured at the tip shall be

Min 3/64 inch

Gauge by eye.

The combined thickness of two bank contacts with the associated separator is 3/64 inch.

- (b) The wiper springs shall exert approximately equal tension on the bank contacts. This requirement is considered met if, when the wiper

assembly enters the bank, the upper and lower springs are deflected approximately equal amounts.

Gauge by eye.

2.08 Relation of Wiper Spring Tips to Bank and Bank Contacts: Fig. 6(A)

- (a) The wiper spring tips shall rest on the bank contacts between the front edge and the middle of the exposed length of the contact.

Gauge by eye using the P-220366 dental mirror.

This requirement need be checked at positions 1 and 10 only. To check position 1, place the dental mirror at approximately the sixth position.

- (b) The wiper spring tips shall rest approximately on the center of each bank contact with respect to the width of the bank contact.

Gauge by eye.

This requirement need be checked at only one position of the wiper tips on the bank.

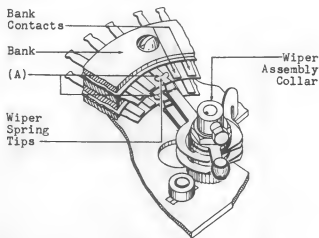


Fig. 6—Alignment of Wiper Springs on Bank Contacts

2.09 Clearance Between the Release Ratchet Dog and Ratchet Teeth

- (a) When the rotary magnet restores from an electrically operated position, there shall be

backward movement of the wiper spring tips on each step but this movement shall not exceed

1/64 inch

Gauge by eye.

- (b) With the rotary magnet electrically energized against a 0.003-inch gauge, the release ratchet dog shall not drop over the associated ratchet tooth on at least one step.

Use the KS-6909 gauge.

To check this requirement, energize the rotary magnet against the 0.003-inch gauge. With the rotary magnet energized, momentarily operate and release the release armature using the KS-6320 orange stick. De-energize the rotary magnet and remove the gauge. This requirement is considered met if the wiper assembly returns to its position on the bank before this check.

2.10 Normal Finger Position

- (a) **Fig. 7(A):** The step from the normal position to the first bank contact shall be approximately equal to the steps between the first and second bank contacts.

Gauge by eye.

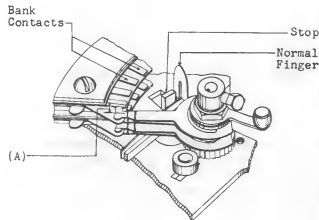


Fig. 7—Normal Position of Wiper Springs

- (b) **Fig. 8(A):** The normal finger shall rest against the stop when the selector is in the normal position, and the free end of the normal finger shall overlap the stop by

Min 1/32 inch

Gauge by eye.

- (c) The normal finger shall not touch the wiper assembly restoring spring or the release armature spring during stepping and release.

Gauge by eye.

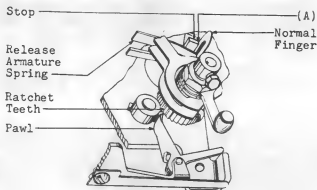


Fig. 8—Position of Normal Finger

RELEASE REQUIREMENTS

*2.11 Freedom of Movement of Release Armature:

Fig. 9(A)—With the wipers in the normal position, the release armature shall not bind on its bearings and shall have sideplay.

Gauge by feel.

*2.12 Release Magnet Heelpiece Airgap: Fig.

9(B)—With the release magnet electrically operated, the armature shall be parallel to the heelpiece as gauged by eye but shall not make contact with the heelpiece nor clear it by more than 0.004 inch at the closest point.

Use the KS-6909 gauge.

*2.13 **Release Armature Travel:** Fig. 9(C)—With the wiper assembly rotated one step from its normal position, the gap between the armature

and core, measured at the closest point when the armature is unoperated, shall be

Test: Min 0.017 inch, Max 0.023 inch

Readjust: Min 0.018 inch, Max 0.022 inch

Use the KS-6909 gauge.

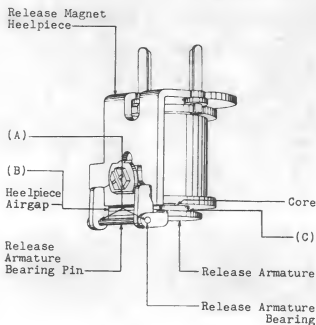


Fig. 9—Release Armature

*2.14 Release Ratchet Dog Alignment

- (a) **Fig. 10(A):** The edge of the release ratchet dog shall engage the radial surfaces of the ratchet teeth approximately flat.

Gauge by eye.

- (b) **Fig. 10(B):** The curved portion of the dog shall not touch the release armature spring when the armature is operated.

Gauge by eye.

*2.15 Release Armature Spring Tension:

Fig. 10(C)—With rotary armature manually operated, the tension of the release armature spring, measured at the bend in the dog, shall cause the

ratchet dog to press against the ratchet with a pressure of

Test: Min 20 grams, Max 45 grams

Readjust: Min 25 grams, Max 40 grams

Use the 68B gauge.

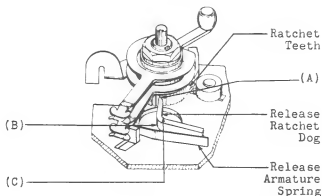


Fig. 10—Alignment of Release Ratchet Dog

2.16 Wiper Assembly Restoring Spring Tension:

With the wiper assembly stepped manually to the first and tenth steps, the tension of the wiper assembly restoring spring shall be sufficient to restore the wipers to normal when the wiper assembly is slightly retarded by hand.

ROTARY REQUIREMENTS

2.17 Rotary Armature Spring Position and Tension

- (a) **Fig. 11(A):** The rotary armature spring shall clear the end of the armature with the armature in every position.

Gauge by eye.

- (b) **Fig. 11(B):** The lower edge of the spring shall be approximately parallel to the main surface of the base.

Gauge by eye.

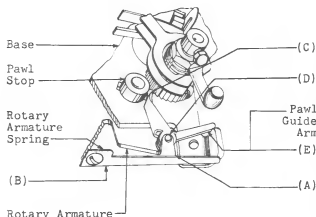


Fig. 11—Rotary Armature Spring Position

- (c) **Fig. 11(C) and 12(A):** The rotary armature spring shall be tensioned to hold the armature backstop against the nonmagnetic stud.

Gauge by eye.

2.18 Freedom of Movement of Rotary Armature:

Fig. 12(B)—The rotary armature shall not bind on its bearings and shall have sideplay.

Gauge by feel.

2.19 Rotary Magnet Heelpiece Airgap:

Fig. 12(C)—With the rotary magnet electrically operated, the armature shall be parallel to the heelpiece as gauged by eye but shall not make contact with the heelpiece nor clear it by more than 0.004 inch at the closest point.

Use the KS-6909 gauge.

- 2.20 Rotary Armature Travel:** Fig. 12(D)—The gap between the armature and core, measured at the closest point when the armature is unoperated, shall be

Test: Min 0.027 inch, Max 0.033 inch

Readjust: Min 0.028 inch, Max 0.032 inch

Use the KS-6938 gauge.

2.21 Pawl Alignment

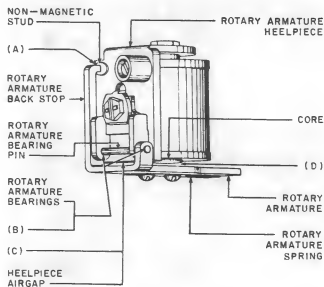


Fig. 12—Relationship of Rotary Armature to Heelpiece and Core

- (a) **Fig. 11(C):** The edge of the pawl shall engage the radial surfaces of the ratchet teeth approximately flat.

Gauge by eye.

- (b) **Fig. 11(D):** The pawl shall not bind on its bearing or on the base.

Gauge by feel.

- 2.22 Pawl Spring Tension:** Fig. 11(E)—The pawl spring shall hold the pawl guide arm against the base with a pressure of

Min 40 grams

Max 110 grams

Use the 79C gauge applied adjacent to the base.

- 2.23 Pawl Guide Arm Position:** Fig. 11(E)—With the wiper springs on the first bank contact and as the rotary armature is operated manually, there shall be a clearance of

Min 0.007 inch

between the pawl guide arm and the base just before or just as the wiper springs begin to move.

Use the KS-6909 gauge.

2.24 Wiper Assembly Rotary Play

- (a) When the rotary magnet is electrically operated and released, the pawl shall not bind between the ratchet wheel and the pawl stop.

Gauge by eye.

- (b) When the rotary magnet is electrically operated, the rotary play of the wiper assembly measured at the wiper tips shall be

Max 0.025 inch

Gauge by eye. The distance between adjacent contacts at their front edge is approximately 0.060 inch.

This requirement need be checked at only one position of the wiper tips on the bank.

OFF-NORMAL REQUIREMENTS

- 2.25 Off-Normal Roller Movement:** Fig. 13(A)
—With the selector in the off-normal position, the off-normal roller shall turn freely on its shaft.

Gauge by feel.

- 2.26 Spring Alignment:** Fig. 13(B)

- (a) The top edge of the contact springs shall be approximately parallel with the base.

Gauge by eye.

- (b) The springs shall not have excessive or irregular bends, and the bowing for tension in the free length of the spring shall not exceed

1/32 inch

Gauge by eye.

- 2.27 Stud Alignment:** Fig. 13(C)—Studs shall be approximately centered with the springs against which they strike.

Gauge by eye.

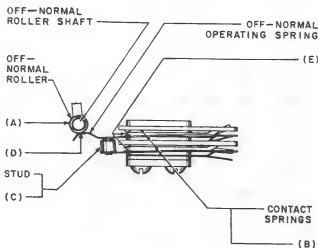


Fig. 13—Off-Normal Operating Spring and Roller Engagement

2.28 Contact Alignment: Fig. 14(A)—Contacts shall not be out of alignment more than 2/5 (40 percent) of their base diameter.

Gauge by eye.

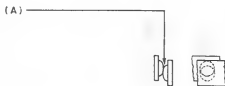


Fig. 14—Contact Alignment

2.29 Off-Normal Operating Spring and Roller Engagement

- (a) **All Selectors Except 204F:** The off-normal operating spring shall engage the off-normal roller approximately in the center of the length of the roller.

Gauge by eye.

- (b) **204F Selector Only:** Fig. 13(D)—With the wiper assembly in its normal position, the off-normal roller shall rest on the surface of

the tip of the operating spring, parallel to the body of the spring.

Gauge by eye.

2.30 Off-Normal Operating Spring Clearance: Fig. 15(A)

- (a) With the wiper assembly resting on the first contact from the normal position and with the play of the off-normal roller taken up in a direction away from the off-normal operating spring, there shall be a perceptible clearance between the off-normal operating spring and the off-normal roller.

Gauge by eye.

- (b) **Selectors Equipped With an Earlier-Type Armature:** The off-normal operating spring shall clear the rotary armature with the armature operated and the wiper assembly off normal.

Gauge by eye.

2.31 Off-Normal Operating Spring Tension:

Fig. 15(B)—The off-normal operating spring shall not prevent the wiper assembly from returning to normal when the wiper springs are released from the first step.

Gauge by eye.

2.32 Second Operating Spring Follow: Where

there are two operating springs in a combination, the stud of the second operating spring may touch the first operating spring, but it shall not follow when the off-normal operating spring is deflected sufficiently to clear the stud. This requirement shall be checked with the wiper springs resting on the first step.

Gauge by eye.

- 2.33 Stud Gap (204A Selector Only):** The clearance between the stud of the second spring and the off-normal operating spring shall be

Min 0.002 inch

Gauge by eye.

2.34 Contact Separation

- (a) **All Selectors:** Fig. 13(E)—The separation between any pair of contacts normally open shall be

Min 0.006 inch

Use the KS-6909 gauge.

- (b) **204B Selector:** The separation between the pair of contacts that are opened when the wiper assembly is rotated to the first step shall be

Min 0.005 inch

Use the KS-6909 gauge.

- (c) **204C, E, and F Selectors:** Fig. 15(C)—With the No. 6 spring resting against the No. 5 spring, the separation between the pair of contacts that are opened when the wiper assembly is rotated to the first step shall be

Min 0.005 inch

Use the KS-6909 gauge.

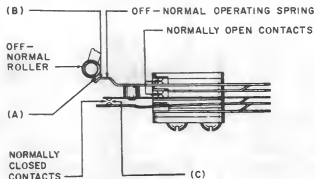


Fig. 15—Off-Normal Operating Spring Clearance

2.35 Contact Pressure

- (a) **Normally Open Contacts** (204A, C, E, and F Selectors): The contact pressure of the off-normal springs when the wiper assembly is rotated to the first step shall be

Min 20 grams

Use the 70J gauge.

In checking the tension of the off-normal operating spring (except the 204A selector), deflect the second operating spring slightly so there will be a gap between the stud and the off-normal operating spring.

(b) Normally Closed Contacts

- (1) **204B Selector:** Contact pressure of the normally closed contacts is insured if requirement 2.36 is met.

- (2) **204C, E, and F Selectors:** With the wiper assembly in its normal position, the contact pressure of the normally closed springs shall be

Min 20 grams

Use the 70J gauge.

2.36 Contact Follow: Where contact pressure is not specified, there shall be a perceptible follow.

Gauge by eye.

ELECTRICAL REQUIREMENTS

2.37 Electrical Requirements

- (a) The selector shall meet the electrical requirements specified on the circuit requirements table.
- (b) Where no electrical requirements are specified on the circuit requirements table, the selector shall step steadily and smoothly when tested by means of approved test apparatus.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Materials, and Test Apparatus

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
45B	5/16-inch hex. socket wrench

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
325B	Adjuster
332	Adjuster
359	Magnet core and armature cleaning tool
363	Spring adjuster (two required)
417A	1/4- and 3/8-inch open double-end flat wrench
418A	5/16- and 7/32-inch open double-end flat wrench
485A	Smooth-jaw pliers
544A	1/4-inch hex. single-end socket wrench
555A	3/16-inch hex. single-end socket wrench
KS-6320	Orange stick
KS-7782	Parallel jaw pliers (two required)
KS-14208	Brush
P-220366	Dental mirror
—	Typewriter brush
—	3-inch C (or the replaced 3-inch cabinet) screwdriver
—	4-inch E (or the replaced 4-inch regular) screwdriver
GAUGES	
68B	70-0-70 gram gauge
70J	0-150 gram gauge
79C	0-200 gram push-pull tension gauge
KS-6909	Gauge
KS-6938	Gauge

CODE OR SPEC NO.	DESCRIPTION
MATERIALS	
KS-2423	Cloth
or	
KS-14666	Cloth
KS-16832 L2	Lubricant
KS-7860	Petroleum spirits
—	Toothpicks, hardwood, flat at one end and pointed at other
—	No. 29 sleeving (aloxite)
—	No. 30 sleeving (oiled)

TEST APPARATUS

35 type	Test set
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3.002 If a selector is mounted so that parts to be treated or adjusted are not readily accessible, remove the selector from its mounting as follows. Tag and disconnect the release magnet leads. Remove the selector mounting screws with the 3-inch C screwdriver and carefully withdraw the selector from its mounting, taking care not to damage the bank leads. In the case of a selector associated with a 197-type switch, first remove the switch from the shelf as covered in Section 030-705-701. Then remove the shaft spring and normal post assembly of the switch as covered in Section 030-705-802 and the vertical off-normal spring assembly as covered in Section 030-705-803 in order to remove the selector. It may be desirable in some cases to support the selector by wire attached to the frame in order to prevent damage to the bank leads while making treatments or adjustments.

3.01 Cleaning: (Req't 2.01)

- (1) Clean the contacts in accordance with approved procedures.
- (2) **General:** Exercise extreme care in cleaning with the KS-7860 petroleum spirits to keep it from coming in contact with the spoolheads of the release and rotary magnets, with any part of the bank, bank contacts, insulators, or bushings, since the liquid has an injurious effect

on these parts. Unless otherwise specified, use a clean toothpick for each operation so as to keep the liquid clean. All parts that are to be lubricated must be allowed to dry thoroughly and then be lubricated in accordance with 3.03.

(3) Take precautions to prevent the KS-7860 petroleum spirits from splattering on adjacent apparatus or dirt from dropping onto the apparatus mounted below.

(4) **Ratchet Teeth and Shaft:** If the shaft and ratchet teeth appear to have an accumulation of gummy oil or foreign substance, remove the wiper assembly from the selector as follows. Remove the wiper assembly collar from the shaft after loosening the collar setscrew with the 3-inch C screwdriver or the 555A socket wrench, depending upon whether the screw has a slotted or hexagonal head. Remove the wiper assembly restoring spring from the lug on the ratchet. Rotate the wipers off the bank to the right, and remove the wiper assembly by lifting it off the shaft. Moisten the KS-14208 brush with KS-7860 petroleum spirits, and flush the ratchet teeth to loosen the dirt. Then clean the teeth with a typewriter brush. Flush the inside of the ratchet wheel bearing with KS-7860 petroleum spirits applied with the KS-14208 brush. Clean the shaft by wiping it clean with KS-2423 or KS-14666 cloth moistened with KS-7860 petroleum spirits. After the shaft is thoroughly dry, wipe it with a clean KS-2423 or KS-14666 cloth that has been slightly moistened with KS-16832 L2 lubricant. Before remounting the wiper assembly, make all cleaning and adjusting operations that appear necessary.

(5) **Pawl Bearing:** If the pawl does not move freely, flush the pawl bearing with KS-7860 petroleum spirits applied with the KS-14208 brush. Then move the pawl back and forth several times to work the dirt out of the bearing.

(6) **Armature Bearing:** If the armatures do not move freely on their bearings and it apparently is due to an accumulation of foreign substance, flush the bearings with KS-7860 petroleum spirits applied with the KS-14208 brush. Then move the armature up and down. This will loosen the matter and work some of it out so it can be removed with a toothpick.

(7) **Armature and Core:** Insert the 359 cleaning tool between the armature and the core, and apply sufficient pressure to the bottom of the armature to force it upward against the cleaning tool. Then forcibly withdraw the cleaning tool. Repeat this operation several times, using first one flat surface of the tool and then the other to remove dust and loose galvanizing scales that may have accumulated between the armature and the core.

Note: If a new 359 cleaning tool is to be used, check whether the tool is covered with a protective film of oil. If this condition exists, remove the film with KS-7860 petroleum spirits applied on a KS-14666 cloth.

3.02 Cleaning and Treating of Bank Contacts and Wipers: (Reqt 2.02)—If necessary, clean and treat the bank contacts and wipers.

3.03 Lubrication: (Reqt 2.03)

(1) Make sure the container of KS-16832 L2 lubricant has been shaken as covered in 1.09. Then lubricate the various parts of the selector using the KS-14208 brush. Distribute the lubricant retained by the brush after each dip as specified.

Caution: *Satisfactory lubrication for the recommended lubrication interval is dependent on taking care that most of the lubricant retained by the brush after each dip is actually deposited at the various lubrication points.*

(2) Remove the wiper assembly collar to facilitate application of lubricant to the wiper assembly bearing. See 3.01(4) of this section for method of removing collar. Apply the lubricant to the shaft at a point just above the end of the wiper assembly bearing so the lubricant will creep into the bearing. In reassembling the collar, place the clamping screw in a position convenient for future loosening of the screw without regard to the position of the oil hole, if an oil hole is provided in the collar.

(3) When lubricating the ratchet, apply the lubricant over the points where the pawl and release ratchet dog engage the ratchet. In some cases it may be necessary to manually rotate the wiper assembly off-normal to permit reaching all ratchet teeth.

- (4) After the lubricant has been applied, operate the selector a few times to work it into the bearings. Wipe off any excess lubricant with a piece of KS-2423 or KS-14666 cloth.

3.04 Record of Lubrication: (Reqt 2.04)—No procedure.

WIPER ASSEMBLY PROCEDURES

3.05 Wiper Assembly Play: (Reqt 2.05)—If the wiper assembly binds, it may be due to some dirt or foreign matter on the shaft, or the wiper assembly collar may be binding on the wiper assembly. If the shaft is dirty, clean it as outlined in 3.01. If the wiper assembly binds on the collar, loosen the setscrew with the 3-inch C screwdriver or 555A socket wrench and move it slightly toward the upper end of the shaft, after which tighten the setscrew securely. Take care in doing this to maintain the alignment between the oil hole and slot where alignment is necessary.

3.06 Wiper Spring Tip Separation: (Reqt 2.06)

3.07 Wiper Spring Tension: (Reqt 2.07)

- (1) If the separation between the wiper spring tips is not satisfactory, rotate the wiper springs off the bank to the right and adjust the tips of the springs with the 363 spring adjuster as shown in Fig. 16.

- (2) If the wiper springs fail to pass smoothly on and off the bank contacts due to the form of the tips having been changed in making this adjustment, attempt to reform them by means of the 363 spring adjuster. If impossible to correct satisfactorily, replace the wiper as outlined in Section 026-708-801.

- (3) The adjustment for wiper spring tension may ordinarily be made manually rotating the wiper assembly off the bank and adjusting the wiper springs with the 363 spring adjuster at the point where the straight portion leaves the circular portion. The upper pair of wiper springs may be adjusted by inserting the 363 spring adjuster through the off-normal spring assembly as shown in Fig. 17 and the lower pair of wiper springs by inserting the adjuster below the springs and between the springs and selector base. This operation may be facilitated if the wiper assembly is removed from the

selector and the wiper springs adjusted while holding the wiper assembly in the hand.

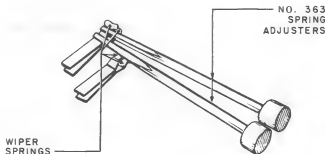


Fig. 16—Method of Adjusting for Wiper Spring Tip Separation

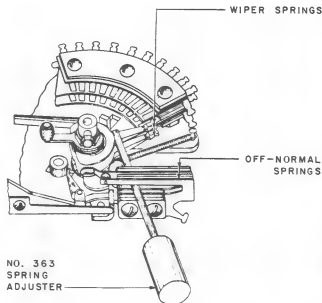


Fig. 17—Method of Adjusting for Wiper Spring Tension

3.08 Relation of Wiper Spring Tips to Bank and Bank Contacts: (Reqt 2.08)

3.09 Clearance Between the Release Ratchet Dog and Ratchet Teeth: (Reqt 2.09)

- (1) If the longitudinal relation between the wiper spring tips and bank contacts is not satisfactory, loosen the two bank mounting nuts

underneath the base with the 45B or 418A wrench and move the bank as required. Then tighten the mounting nuts securely.

(2) Failure of the wiper spring tips to rest approximately on the center of each bank contact with respect to the width of the contact may be due to misalignment of the tips of the pair of wiper springs. If the tips are misaligned and the wiper assembly is tight, replace the wiper assembly as covered in Section 026-708-801. However, if the wiper assembly is loose, proceed as follows. Position the pair of wiper spring tips so they are in proper alignment with each other and with the bank contacts. Then securely tighten the nut just above the wiper springs with the 417A wrench, taking care that the wiper spring tips are not misaligned. Recheck requirements 2.08 and 2.09.

(3) If the wiper spring tips are in alignment and requirement 2.08(b) is not met, the condition may be corrected by repositioning the bank as covered in (1) or, if only a slight adjustment is necessary, by adjusting the tip of the release ratchet dog with the 325B adjuster. Apply the adjuster through the circular opening in the bottom of the base as shown in Fig. 18, and move the adjuster slightly toward or away from the bank as required. This adjustment will change the angle of the tip of the release ratchet dog. If the wiper spring tips are too far to the left of the center of the contact, move the adjuster slightly toward the bank. If the wiper spring tips are too far to the right of the center of the contact, move the adjuster away from the bank. After making this adjustment, see that the clearance between the release ratchet dog and the ratchet teeth and the release armature stroke is satisfactory.

(4) If the backward movement of the wiper spring tip is insufficient or too great or if the release ratchet dog drops into the associated ratchet tooth when the rotary magnet restores from an electrically operated position, adjust the release ratchet dog closer to or further away from the radial face of the tooth using the 325B adjuster as shown in Fig. 18.

3.10 Normal Finger Position: (Req't 2.10)

(1) If the wiper-spring tips are not satisfactorily located when the switch is in the normal

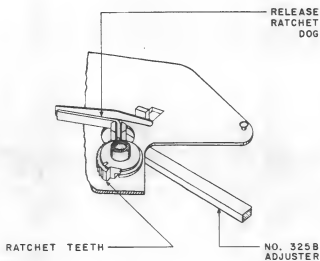


Fig. 18—Method of Adjusting for Relation of Wiper Spring Tips to Bank and Bank Contacts Using 325B Adjuster

position, adjust the normal finger as shown in Fig. 19 with the KS-7782 parallel jaw pliers until the position of the wiper spring tips is satisfactory.

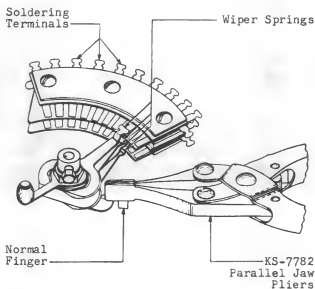


Fig. 19—Method of Adjusting for Relation of Wiper Spring Tips to Bank and Bank Contacts Using Parallel Jaw Pliers

- (2) If the normal finger does not rest against the normal stop or clear the release armature spring and the wiper assembly restoring spring satisfactorily, adjust the normal finger upward or downward as required using the KS-7782 pliers.

RELEASE PROCEDURES

3.11 *Freedom of Movement of Release Armature:*

(Req't 2.11)—If the release armature does not move freely on its bearings, it may be due to an accumulation of foreign substance collecting in the bearings. If they are dirty, clean them as outlined in 3.01.

3.12 *Release Magnet Heelpiece Airgap:* (Req't

2.12)—To realign the release magnet heelpiece and the release armature or to change the airgap between these parts, loosen the release armature yoke mounting screw with the #544A wrench or 4-inch E screwdriver and move the armature slightly away from the release magnet heelpiece. Tighten the mounting screw fingertight. Insert a 0.003-inch gauge between the armature and heelpiece along the width of the heelpiece. Energize the magnet electrically. Then, while holding the gauge in place, loosen the mounting screw and, with the KS-6320 orange stick, move the armature in the direction of the magnet. Exercise care not to touch the yoke. The purpose of moving the armature is to take up all the play in the bearings in the direction of the heelpiece. Hold the armature in this position with the fingers, and tighten the mounting screw securely. (See *Caution.*) De-energize the magnet and remove the gauge.

⚡Caution: Excessive tightening will result in possible screw breakage or stripping.

3.13 *Release Armature Travel:* (Req't 2.13)

3.14 *Release Ratchet Dog Alignment:* (Req't 2.14)

3.15 *Release Armature Spring Tension:* (Req't 2.15)

- (1) If the armature travel is unsatisfactory, check the release magnet heelpiece airgap and, if it is not satisfactory, readjust as outlined in 3.12. If it is satisfactory, adjust the release ratchet dog with the 332 adjuster applied close to the base of the release armature spring. Note that

the wiper spring tips still rest on the center of the bank contacts with respect to the width, and the selector steps satisfactorily after this adjustment has been completed. At this time, note that the engaging surface of the release ratchet dog is aligned with the ratchet teeth.

- (2) To change the tension of the release armature spring, adjust it with the 363 spring adjuster near the base of the spring.

- (3) If the release ratchet dog touches the release armature spring when the release armature is operated, note that the release armature spring is free of kinks or sharp bends and correct if necessary using the 363 spring adjuster and the 485A pliers. If any adjustment is made on the spring, check that it meets its tension requirement.

3.16 *Wiper Assembly Restoring Spring Tension:* (Req't 2.16)

- (1) If the tension of the spring is insufficient, remove the spring from the normal finger lug and replace it with a new spring.
- (2) If the tension of the spring is excessive, remove the spring from the normal finger lug, stretch it slightly, and then remount it.

ROTARY PROCEDURES

3.17 *Rotary Armature Spring Position and Tension:* (Req't 2.17)

- (1) If the rotary armature spring does not clear the end of the armature, it may be due to the armature travel being too great. If necessary, adjust for rotary armature travel as outlined in 3.20.
- (2) If the armature travel is within the limits, hold the rotary armature operated, grasp the rotary armature spring firmly at the end of the spring with the KS-7782 pliers, and draw the pliers toward the armature. Take care when adjusting a spring in this manner not to break it.
- (3) If the spring is not in correct alignment with the base, loosen the spring mounting screws with the 3-inch C screwdriver and shift the spring.

(4) If the rotary armature backstop does not rest against the nonmagnetic stud, it is an indication that the tension of the rotary armature spring is insufficient. Tension the rotary armature spring with the KS-7782 pliers as outlined in (2). In making this adjustment, do not tension the spring sufficiently to prevent the selector from meeting its electrical requirements.

3.18 Freedom of Movement of Rotary Armature: (Reqt 2.18)—If the rotary armature does not move freely in its bearings, clean it as outlined in 3.01.

3.19 Rotary Magnet Heelpiece Airgap: (Reqt 2.19)—If the alignment of the heelpiece and rotary armature or the rotary magnet heelpiece airgap is unsatisfactory, proceed as outlined in 3.12 for correcting release magnet heelpiece airgap.

3.20 Rotary Armature Travel (Reqt 2.20): If the armature travel is unsatisfactory, check the heelpiece airgap and, if it is unsatisfactory, adjust as covered in 3.12. If the heelpiece airgap is satisfactory, adjust the rotary armature backstop toward or away from the heelpiece as required with the 485A pliers.

3.21 Pawl Alignment: (Reqt 2.21)

(1) If the pawl is not aligned with the ratchet teeth or it binds on the base, replace the rotary armature assembly as outlined in Section 026-708-801.

(2) If the pawl binds in its bearings, clean it as outlined in 3.01.

3.22 Pawl Spring Tension: (Reqt 2.22)—If the tension of the pawl spring is too great or insufficient, replace the rotary armature assembly.

3.23 Pawl Guide Arm Position: (Reqt 2.23)—To adjust the position of the pawl guide arm, hold the guide arm near the end of the rotary armature with a pair of 485A pliers, and grasp the guide arm near the free end with the KS-7782 pliers. Adjust the arm toward or away from the switch frame as required. After making this adjustment, check the armature travel and, if it is unsatisfactory, readjust as covered in 3.20.

3.24 Wiper Assembly Rotary Play: (Reqt 2.24)—If the pawl strikes the stop before

the armature strikes the core or the play in the wiper assembly is not satisfactory, loosen the pawl stop screw underneath the selector with the 45B or 418A wrench, and shift the pawl stop as required. Tighten the screw securely.

OFF-NORMAL PROCEDURES

3.25 Off-Normal Roller Movement: (Reqt 2.25)—If the roller does not turn freely on the shaft, it may be due to an accumulation of dirt or a gummy substance. Revolve the roller until it works freely. Do not use any solvent to clean the roller.

3.26 Spring Alignment: (Reqt 2.26)

3.27 Stud Alignment: (Reqt 2.27)

3.28 Contact Alignment: (Reqt 2.28)

3.29 Off-Normal Operating Spring and Roller Engagement: (Reqt 2.29)

3.30 Off-Normal Operating Spring Clearance (Reqt 2.30)

3.31 Off-Normal Operating Spring Tension: (Reqt 2.31)

3.32 Second Operating Spring Follow: (Reqt 2.32)

3.33 Stud Gap: (Reqt 2.33)

3.34 Contact Separation: (Reqt 2.34)

3.35 Contact Pressure: (Reqt 2.35)

3.36 Contact Follow: (Reqt 2.36)

(1) When making these adjustments, consult the associated circuit drawing and circuit requirements table and give proper consideration to the maintenance of any requirement for contact sequence which may be specified thereon.

(2) **Spring Alignment, Stud Alignment, Contact Alignment, and Off-Normal Operating Spring and Roller Engagement:** If the alignment of the contact springs, studs, or contacts is unsatisfactory, or if the engagement of the off-normal operating spring and roller is unsatisfactory, loosen the spring assembly screws

with the 3-inch C screwdriver, and shift the springs as required. Tighten the screws securely. If a spring is excessively bowed or bent, straighten the spring before adjusting to meet the contact pressure requirement. To straighten the spring, apply the KS-7782 pliers to the spring just back of the bow or bend and, while exerting pressure to the right or left as required, draw the pliers forward the length of the bow. Repeat this operation as required until the spring is approximately straight. Take care when adjusting the springs to adjust them in line with their movement and to avoid tilting the spring.

(3) Off-Normal Operating Spring Clearance and Off-Normal Operating Spring Tension:

If these requirements are not met, the trouble may be due to either distortion of the off-normal operating spring, the position of the off-normal spring assembly bracket, or position of the first contact spring. To correct, check the position of the bracket and, if it is improperly positioned, loosen the bracket assembly mounting screws with the 3-inch C screwdriver and shift the bracket as required. Tighten the screw.

(4) If the bracket is satisfactorily located and the trouble persists, compare the shape of the spring at the roller with a spring known to be in satisfactory adjustment. If the spring is unsatisfactory, adjust the tip of the spring at the point where the long, straight portion meets the offset portion of the spring with the 363 spring adjuster and again compare it with the spring in satisfactory adjustment. After adjusting the spring, check that it engages the roller approximately in the center.

(5) If satisfactory clearance cannot be obtained as outlined above, adjust the position of the heavy contact spring associated with the first operating spring as required with the KS-7782 pliers.

(6) **Second Operating Spring Follow:** If the stud of the second operating spring follows the off-normal operating spring as the off-normal operating spring is deflected, adjust the No. 3 spring toward the second operating spring as covered in (7).

(7) **Contact Separation:** If the separation between the contacts is not satisfactory, adjust the position of the heavy contact spring

as required with the KS-7782 pliers. In making this adjustment, grasp the spring at the end of the long straight portion with the pliers, and adjust the spring toward or away from its associated spring.

(8) Contact Pressure and Contact Follow:

To adjust an operating spring for contact pressure or contact follow, place the KS-7782 pliers on the spring at the point where the long portion of the spring leaves the short portion and adjust the spring toward or away from its associated contact as required, exercising care not to disturb adjacent springs.

(9) If the desired adjustment cannot be obtained by adjusting as covered in (8) without bowing the spring beyond its permissible limit, place the KS-7782 pliers on the spring as covered in (8), and draw the pliers the length of the spring, meanwhile applying pressure as required so the spring is formed into a slight gradual bow with the concave surface facing the associated spring. The magnitude of the bow to be formed in the spring must be learned by experience and should be such that, when the final tension adjustment is made at the end of the long portion of the spring, the spring will be approximately straight. Move the pliers to the end of the long portion of the spring, and adjust as covered in (8).

(10) If a satisfactory adjustment cannot be obtained as covered in (8) and (9) without removing the spring assembly mounting bracket from the selector, remove the spring assembly mounting bracket screws with the 3-inch C screwdriver and remove the mounting bracket. Grasp the short portion of the spring to be adjusted with one pair of KS-7782 pliers and the long portion of the spring with another pair of KS-7782 pliers and adjust as covered in (8) and (9).

(11) Do not straighten kinked springs unless the kink interferes with the proper adjustment of the spring assembly. Removing kinks tends to weaken the spring and to shorten its life. Normally straight springs that have been adjusted should have no sharp bends due to adjustment. A gradual bow, however, is permissible.

(12) If, after the above adjustments have been made, it is necessary to change the contact separation or contact follow, place the KS-7782

pliers just in back of the contact and adjust the spring toward or away from the associated spring as required.

3.37 Electrical Requirements: (Reqt 2.37)—If difficulty is experienced in meeting the electrical requirements, the tension of the wiper assembly restoring spring or the rotary armature spring may be unsatisfactory. Check the tension

of the wiper assembly restoring spring and, if necessary, adjust as outlined in 3.16. If the tension of the rotary armature spring is unsatisfactory, increase or decrease the tension of the spring as outlined in 3.17. Increasing the tension slows the operation and speeds the release. Decreasing the tension speeds the operation and slows the release. Check that the spring mounting screws are tight and the rotary armature travel is correct.